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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 065623

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

PROCESS INSPECTOR (ORDNANCE) 736.381
~~INSPECTOR, MISCELLANEOUS (aircraft mfg.) 6-78.685~~

~~B-554~~

S-277

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EDUCATION & WELFARE
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TM 001 923

U. S. Employment Service
in Cooperation with
Texas State Employment Service

August 1963

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

# FOR

# INSPECTOR, MISCELLANEOUS 6-78.685

# B-554

## Summary

The General Aptitude Test Battery, B-1001, was administered to a final sample of 57 men employed as Inspector, Miscellaneous 6-78.685 at the Thiokol Chemical Corporation, Karnack, Texas. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes N-Numerical Aptitude, S-Spatial Aptitude and P-Form Perception were selected for inclusion in the final test norms.

GATB Norms for Inspector, Miscellaneous 6-78.685, B-554

| B-1001 | | | B-1002 | | |
|---|---|---|---|---|---|
| Aptitude | Tests | Minimum Acceptable Aptitude Score | Aptitude | Tests | Minimum Acceptable Aptitude Score |
| N | CB-1- D<br>CB-1- I | 105 | N | Part 2<br>Part 6 | 100 |
| S | CB-1- F<br>CB-1- H | 105 | S | Part 3 | 100 |
| P | CB-1- A<br>CB-1- L | 95 | P | Part 5<br>Part 7 | 95 |

## Effectiveness of Norms

The data in Table IV indicate that only 70 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 97 percent would have been good workers. 30 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 3 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Inspector, Miscellaneous 6-78.685.

II. Sample

The GATB, B-1001, was administered during the period September 1962 through April 1963 to a total sample of 57 men employed as Inspectors at the Thiokol Chemical Corporation, Karnack, Texas. The minimum training period for this job is thirty days; all individuals in the sample had completed this training and are therefore considered experienced. Tests were not used in selecting individuals for employment in this occupation.

TABLE I

Means (M), Standard Deviations ($\sigma$), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

| N = 57 | M | $\sigma$ | Range | r |
|---|---|---|---|---|
| Age (years) | 35.9 | 8.3 | 24-55 | -.217 |
| Education (years) | 12.2 | 1.7 | 7-14 | -.282 |
| Experience (months) | 44.5 | 26.1 | 2-110 | .296* |

*Significant at the .05 level

III. Job Description

Job Title: Inspector, Miscellaneous 6-78.685

Job Summary: Inspects and measures each metal part of a variety of sizes and types of rocket motors, using precision measuring instruments and records dimensions and deviations. Periodically checks all measuring instruments against master gages for accuracy. Takes and identifies samples of all incoming materials and all mixes of coatings, igniter and propellant mixtures for the chemical laboratory. Records all times, temperatures, and weights for all mixing, coating, curing and casting operations. X-Rays some metal parts and all cast motors for width and thickness of laps, faults in metal and for faults, voids or separations in the propellant. Observes all operations for proper sequence and execution. Observes assembling of motor parts and the torqueing and safety wiring of bolts. Records deviations as shown on dial indicators of alignment machines and records weights and computes center of gravity of motors on center of gravity machine. Inspects painting and stenciling of coverage and runs of motor cases and packing cases. Checks humidity content of finished motors and pressure and pressure retention of packing cases.

Work Performed: Checks threads on a wide variety of types and sizes of bolts and screws, according to blueprints and specifications, using proper thread gages. Tags boxes of inspected bolts with proper color inspection tag; and records date and signature on tab. Checks thickness of washers with thickness gage; and checks diameter of opening with plug gage. Measures throat of nozzle (smallest diameter) with inside vernier calipers; and takes reading from calipers with micrometers. Measures inside and outside diameter of flange, using micrometers; and enters measurements on inspection report. Checks blueprints and specifications to determine proper measurements and tolerances.

Periodically checks all measuring instruments, such as micrometers, gages and dial indicators against master gages for accuracy; records and maintains card record of inspections. Checks calibrations on micrometers by measuring a series of gage blocks. Enters tests on Gage Record Card. Checks thickness gages with parallel bars. Places metal part to be tested on machine table; inserts proper size metal ball for range to be tested into holder of Rockwell machine; pulls lever to apply pressure to cause ball to make an impression in metal; reads dial to obtain hardness index of metal.

Identifies and sends samples of igniter ingredients and of each mix of igniter materials to the chemical laboratory for analysis; weighs and measures coated sheets; inspects assembly of igniter strips; tests electrical resistance of wiring; checks and records weight of pellet type igniter materials; inspects shipping cans for proper painting and marking; records types and weights on Inspector's Report.

Measures motor cases and visually examines for faults, damage or contamination; checks serial numbers and assigns processing number; observes cleaning and degreasing operations; checks weights, mixing, application and curing of lining compound; checks scales and records gross and net weights of each case; affixes passed, rejected or hold tags to each case.

Inspects cores for damage and for proper covering; inspects Teflon coating for proper application and cure and release coating for proper application. Examines mandrells (cores) for adequate covering of Teflon, dents, scratches, contamination, protuberances or other faults; checks sanded cores for smoothness; inspects Teflon sprayed cores for smoothness, skips, runs or proper thickness of covering. Inspects release material for proper consistency; and checks painted cores for proper coverage, thickness, skips and runs.

Observes and records the mixing of semi-liquid and dry ingredients in a rotary mixer to form a slurry type propellant mixture from a remote control panel equipped with temperature charts, flow indicators and a closed circuit television screen. Inspects mixture for color, texture and general appearance and sends samples to the chemical laboratory. Observes the placement of cores and the filling of a variety of large and small motors with propellant . fuel. Records time, temperatures, mix numbers and serial numbers of motors and checks the fill level and the appearance of bubbles being vibrated from mixture.

Checks and records the heat curing of slurry filled motors through a series of specified cam controlled and timed temperature changes in an oven to properly condition and solidify propellants. Observes the pulling of cores, removal of casting sleeves and cutback of excess propellant from the case; observes the cleaning of threads and the screwing of adapters and nozzles onto cases. Checks the alignment of nozzles and cases with the alignment machine. Inspects the cleaning and painting of motors for coverage, runs, contaminants or skips. Inspects the stenciling of motors and shipping cases and the packaging of motors and igniters.

X-Rays metal cases and other metal parts to determine thickness and width of metal laps in welds and detect weld defects, also x-rays finished motors to detect bubbles, voids,or other faults in porpellant, using cathode tubes, film, lead sheets,and lead backed film and irradiated cobalt.

Observes removal of cores and records pressure at which each core releases. Inspects cores for adhering particles. Measures level of cut-back of excess propellant and examines surface and interior of motor for separations, voids, color and appearance. Inspects machined surfaces of flanges and adapters, checks threads of flanges and bolts. Witnesses torque tightening and safety wiring of adapters to case flanges.

Inspects the installation of nozzles, starter motors, articulation skins, electrical cables and other parts. Observes torque and safety wiring of bolts. Checks mixing and application of various adhesives and sealing compounds. Measures humidity of air in motor. Computes center of gravity with center of gravity machine. Computes gross weights of case and parts and net weights of propellant. Examines paint and stenciling of motor and shipping case. Inspects placement of motors, sealing and pressurizing of shipping case. Measures electrical resistance withing prescribed limits of each electrical cable and mercury switch with ohm meter.

IV. Experimental Battery

All the tests of the GATB, B-1001, . were administered to the sample group.

V. Criterion

The criterion data collected consisted of supervisory ratings made on USES Form SP-21, "Descriptive Rating Scale." The rating scale consisted of nine items covering different aspects of job performance, with five alternatives for each item. Weights of one through five, indicating the degree of job proficiency attained, were assigned to the alternatives. The distribution of the final scores was 51-90 with a mean of 69.0 and a standard deviation of 9.8.

VI Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required in learning the proper procedures and safety precautions and in learning to operate a wide variety of equipment such as x-ray machines, alignment machines, ohm meters, etc.

Numerical Aptitude (N) - required in computing net and tare weights and in using formulas to compute centers of gravity.

Spatial Aptitude (S) - required in reading and interpreting blueprints and specifications.

Form Perception (P) - required in inspecting machines and metal parts for damage and in visually inspecting plugs for proper placement.

Finger Dexterity (F) - required in using a variety of precision measuring instruments, such as calipers, micrometers, rules, dial indicators, etc., and a variety of tool-makers instruments, such as super-micrometers, master indicators and parallel bars.

On the basis of the job analysis data, V-Verbal Aptitude was rated "irrelevant" for success in this occupation.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations ($\sigma$), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 57

| Aptitudes | M | $\sigma$ | r |
|---|---|---|---|
| G-Intelligence | 120.1 | 7.9 | .237 |
| V-Verbal Aptitude | 108.5 | 10.5 | -.170 |
| N-Numerical Aptitude | 118.0 | 9.2 | .225 |
| S-Spatial Aptitude | 116.7 | 16.7 | .308* |
| P-Form Perception | 108.8 | 12.7 | .205 |
| Q-Clerical Perception | 97.9 | 13.5 | .363** |
| A-Aiming | 100.2 | 13.9 | .062 |
| T-Motor Speed | 98.1 | 15.6 | .049 |
| F-Finger Dexterity | 98.8 | 17.6 | .372** |
| M-Manual Dexterity | 103.3 | 17.5 | .112 |

*Significant at the .05 level
**Significant at the .01 level

C. Selection of Test Norms:

TABLE III

Summary of Qualitative and Quantitative Data

| Type of Evidence | Aptitudes | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | G | V | N | S | P | Q | A | T | F | M |
| Job Analysis Data | | | | | | | | | | |
| Important | X | | X | X | X | | | | X | |
| Irrelevant | | X | | | | | | | | |
| Relatively High Mean | X | | X | X | | | | | | |
| Relatively Low Sigma | X | X | X | | X | | | | | |
| Significant Correlation with Criterion | | | | X | | X | | | X | |
| Aptitudes to be Considered for Trial Norms | G | | N | S | P | Q | | | F | |

Trial norms consisting of various combinations of Aptitudes G,N,S,P,Q and F with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1001 norms consisting of N-105, S-105 and P-95 had the best selective efficiency; equivalent B-1002 norms are N-100, S-100, P-95.

VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 30 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between B-1002 norms consisting of Aptitudes N, S and P with critical scores of 100, 100 and 95, respectively, and the dichotomized criterion for Inspector, Miscellaneous 6-78.685. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Inspector, Miscellaneous 6-78.685
(N-100, S-100, P-95)

| N = 57 | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 6 | 34 | 40 |
| Poor Workers | 16 | 1 | 17 |
| Total | 22 | 35 | 57 |

Phi Coefficient = .744
$\chi^2$ = 31.578
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes N, S and P with minimum scores of 100, 100 and 95, respectively, have been established as B-1002 norms for Inspector, Miscellaneous 6-78.685. The equivalent B-1001 norms consist of N-105, S-105 and P-95.

IX. Determination of Occupational Aptitude Pattern

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 35 OAP's included in Section II of the Guide to the Use of the General Aptitude Test Battery, January 1962. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.